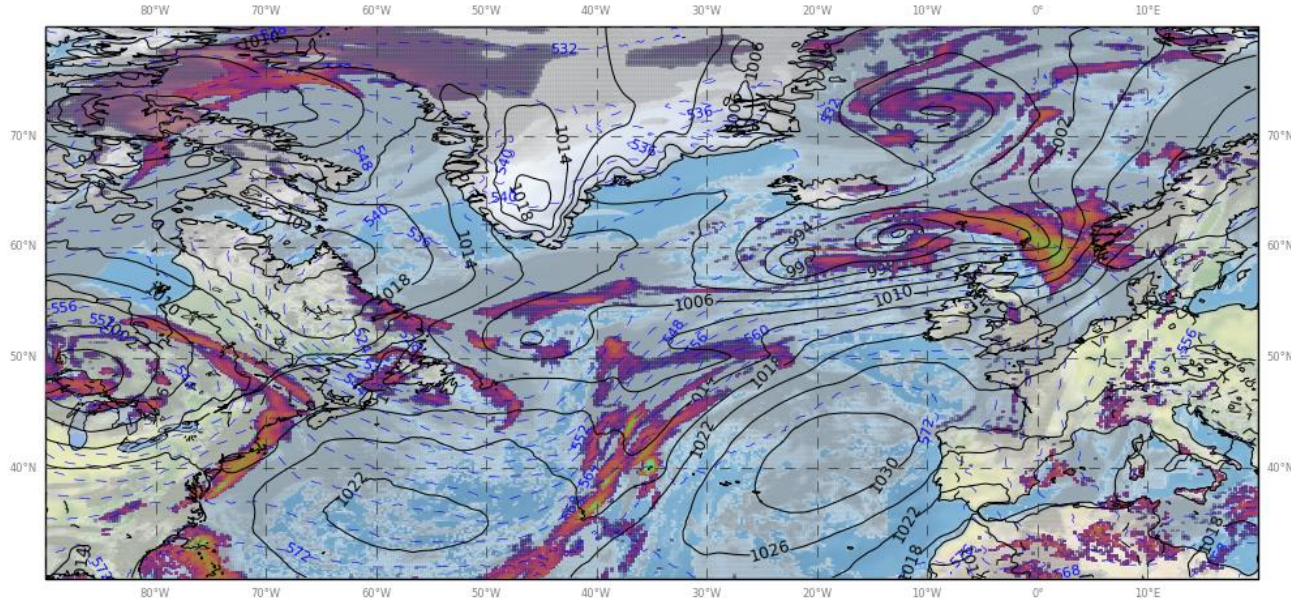


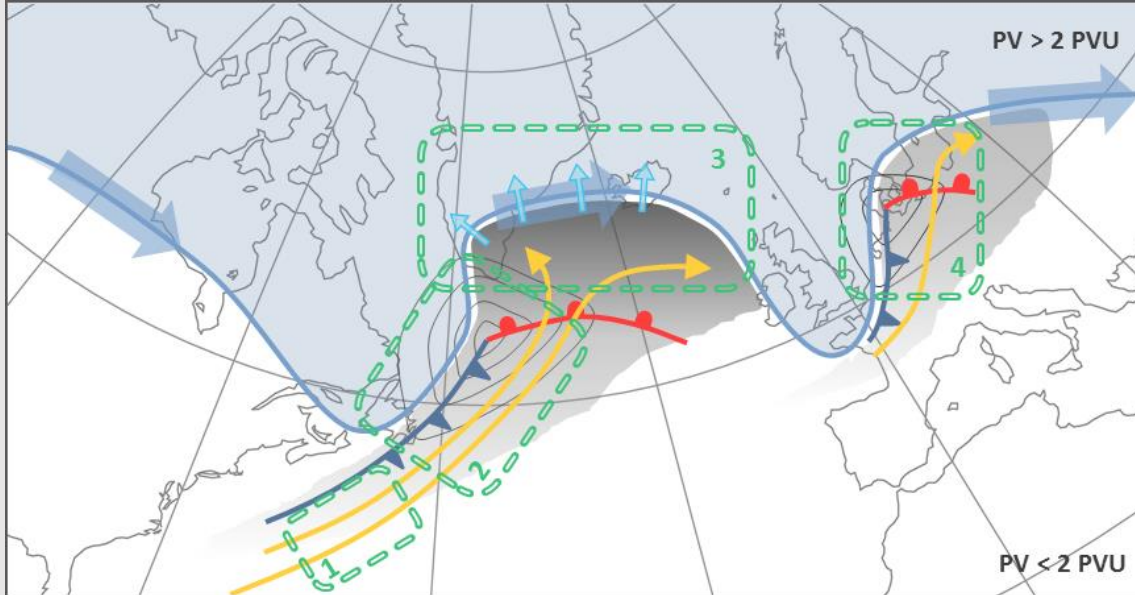
Introduction to the NAWDEX case study: Extratropical phase of tropical storm Karl

Ben Harvey (NCAS / Reading Uni)



Overarching Science Aim of NAWDEX

To quantify the effects of **diabatic processes** on disturbances to the **jet stream** near **North America**, their influence on **downstream propagation** across the **North Atlantic**, and consequences for **high-impact weather** in **Europe**

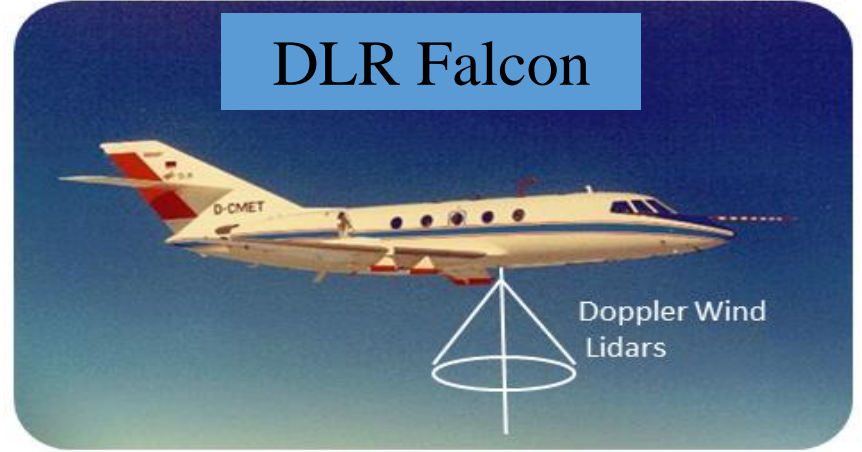


Features related to the meandering **tropopause** and **jet stream**, developing weather systems and **warm conveyor belts (WCB)**

HALO



DLR Falcon



SAFIRE Falcon



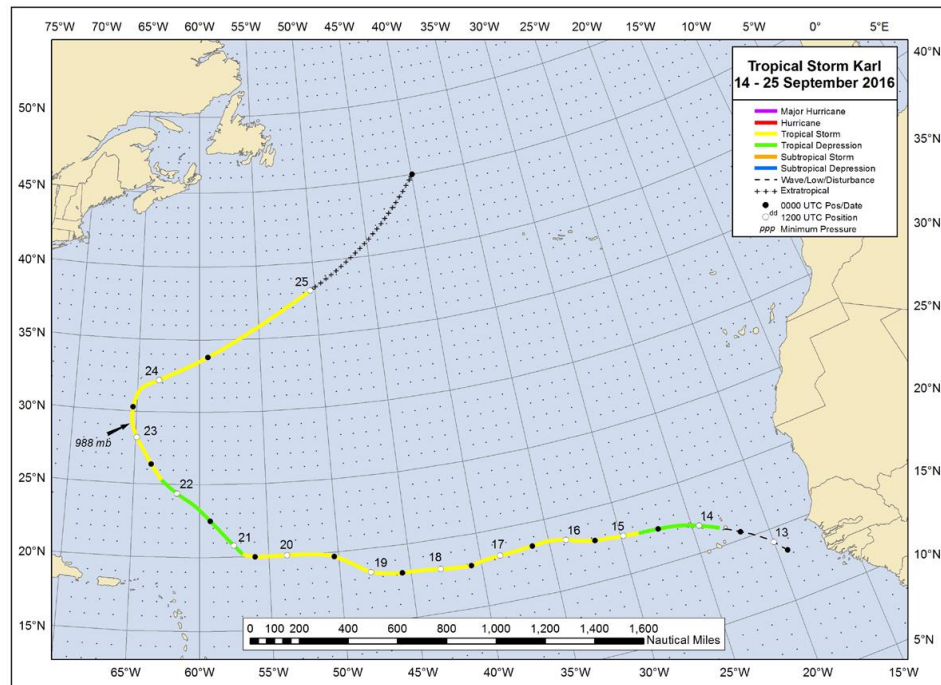
FAAM BAe146



Key dates:

Extra-tropical transition of Tropical Storm Karl

- Karl was a long-lived tropical system which reached tropical storm intensity on **15 Sept**



Best Track position for TS Karl (from NHC TC report)

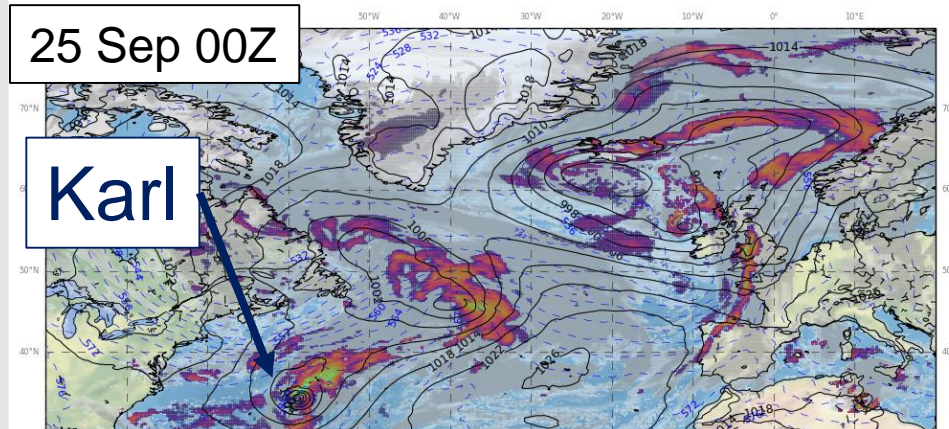
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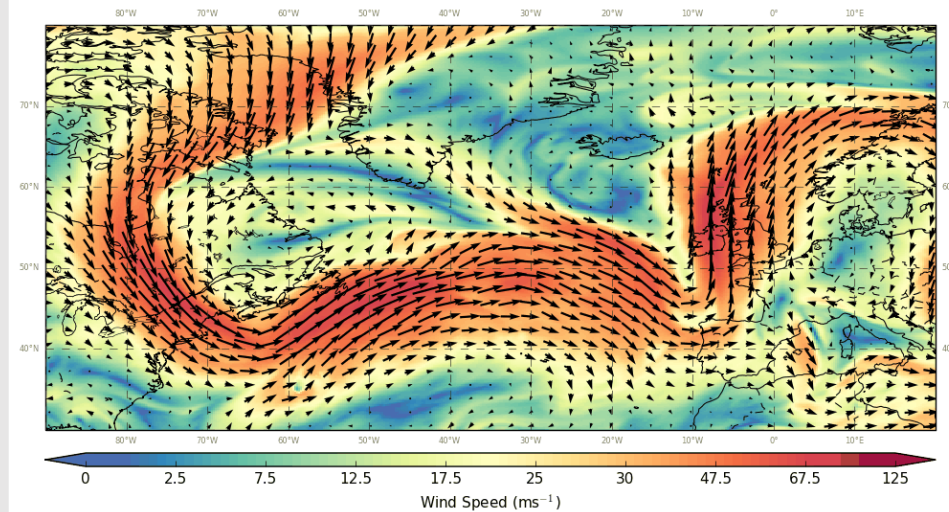
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- Progressed polewards rapidly on **25 Sept**



Precipitation and Clouds



300hPa Wind Speed and Direction



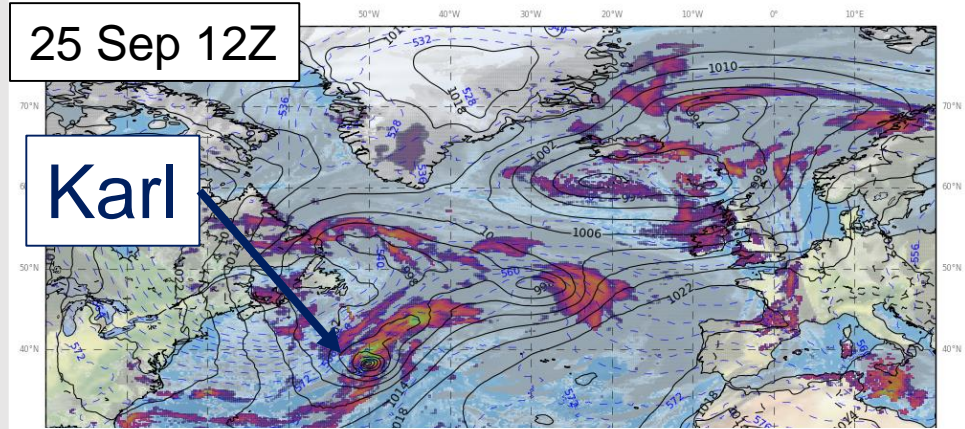
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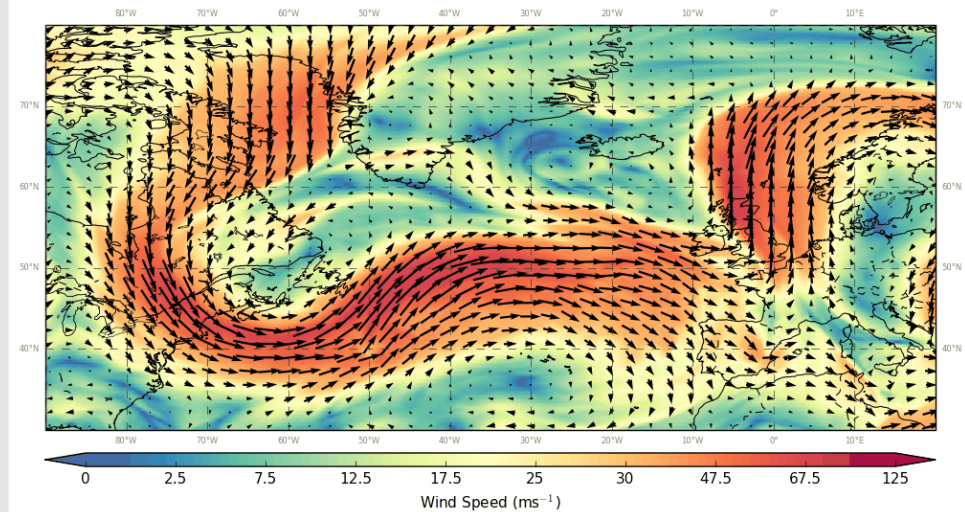
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Precipitation and Clouds



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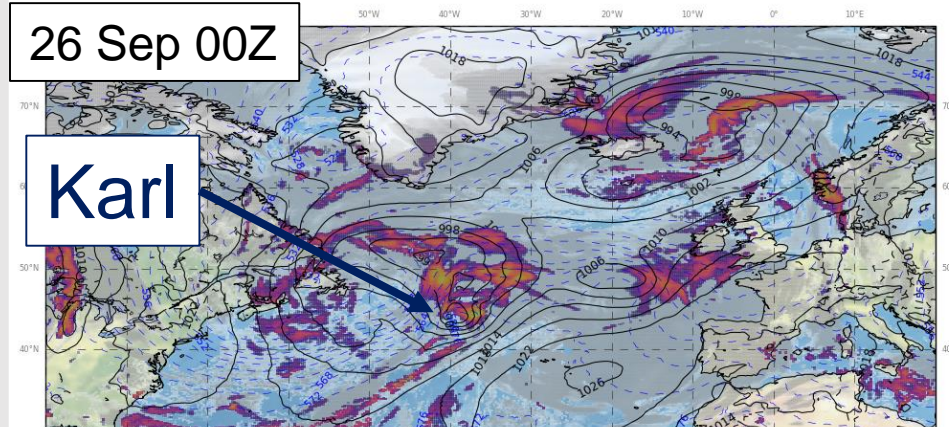
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Precipitation and Clouds



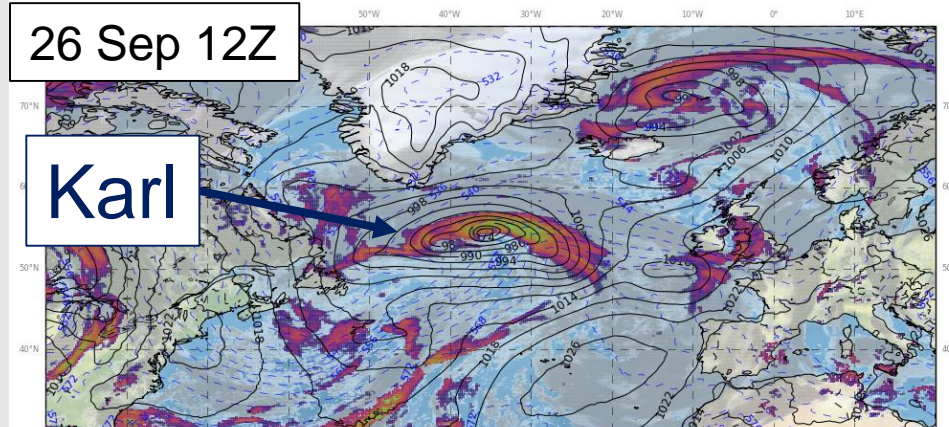
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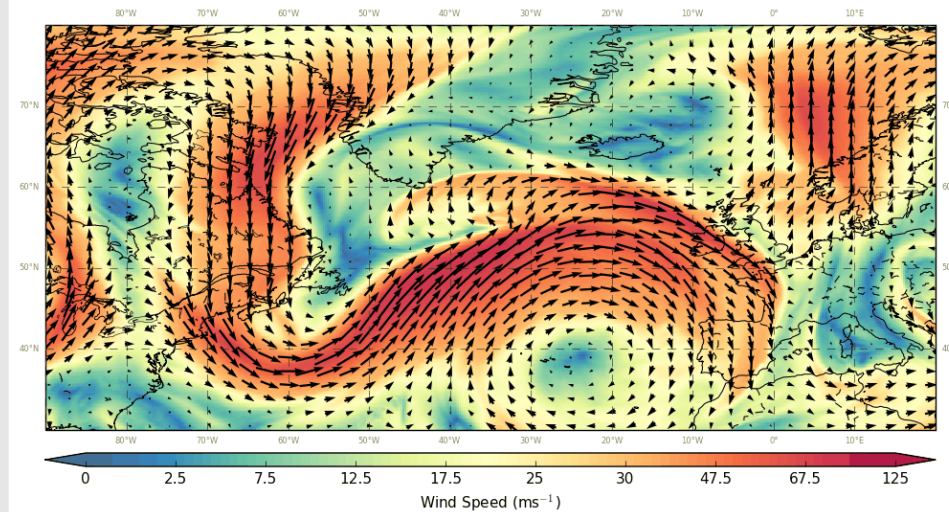
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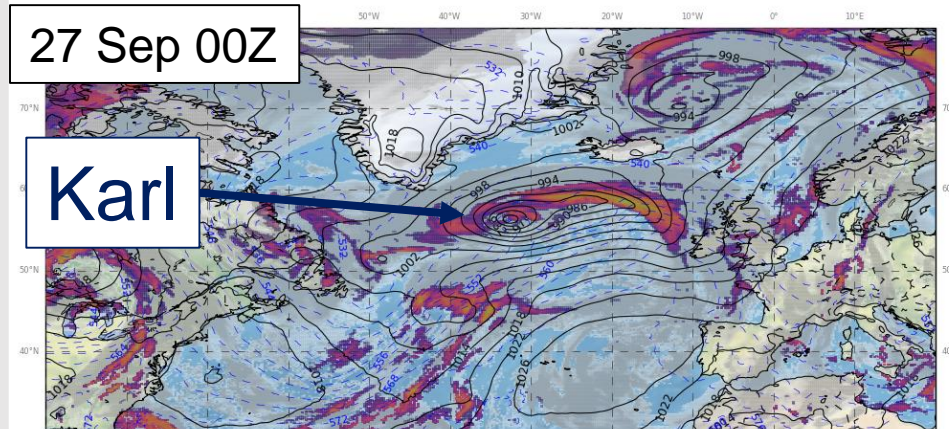
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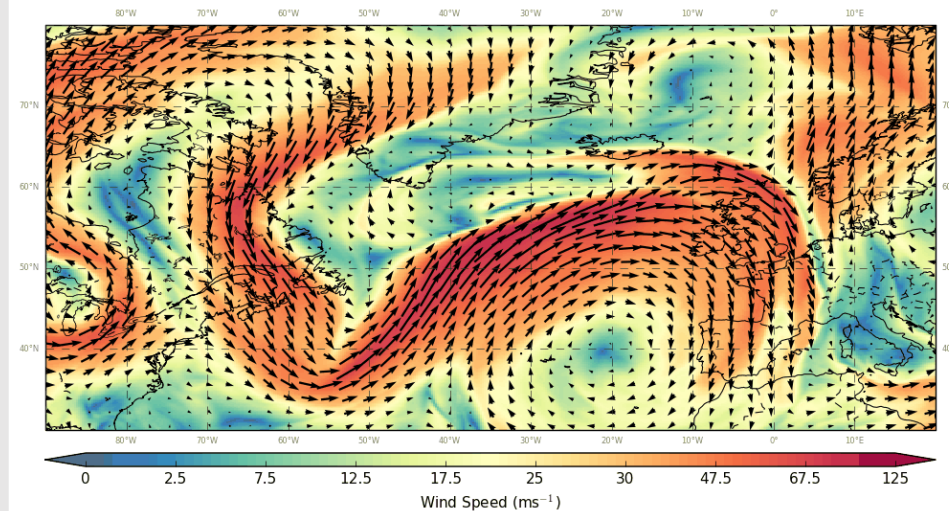
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Precipitation and Clouds



300hPa Wind Speed and Direction



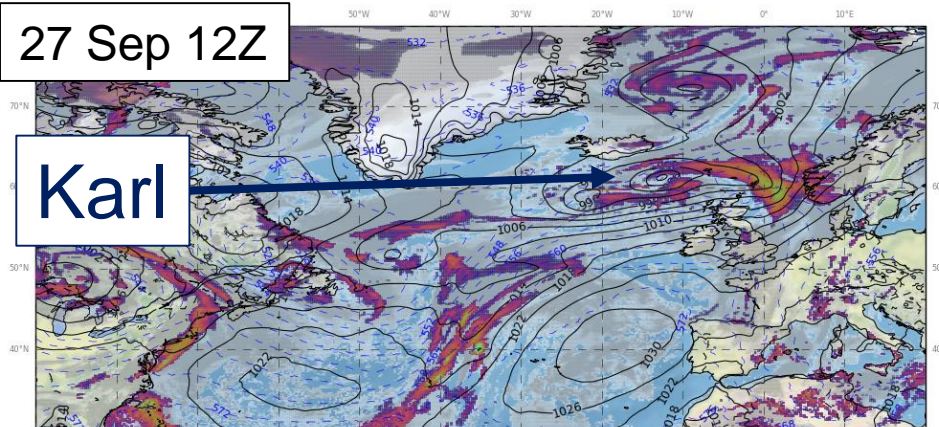
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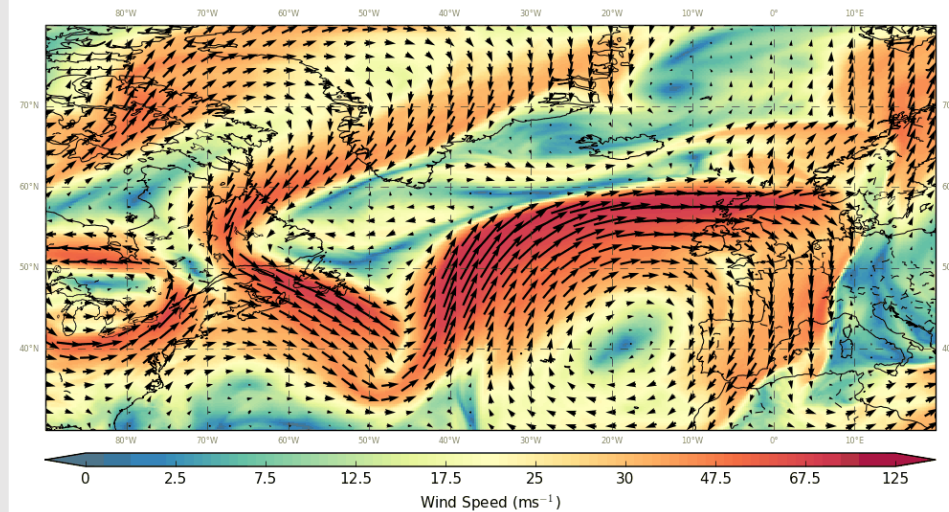
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Precipitation and Clouds



300hPa Wind Speed and Direction



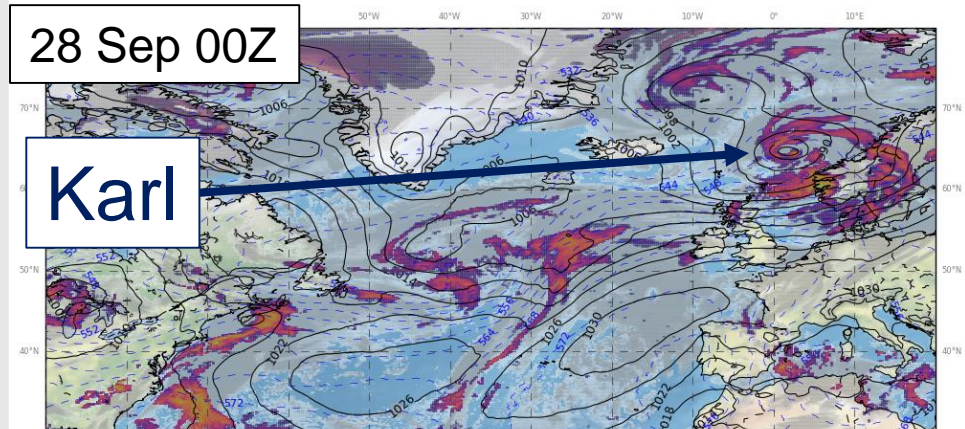
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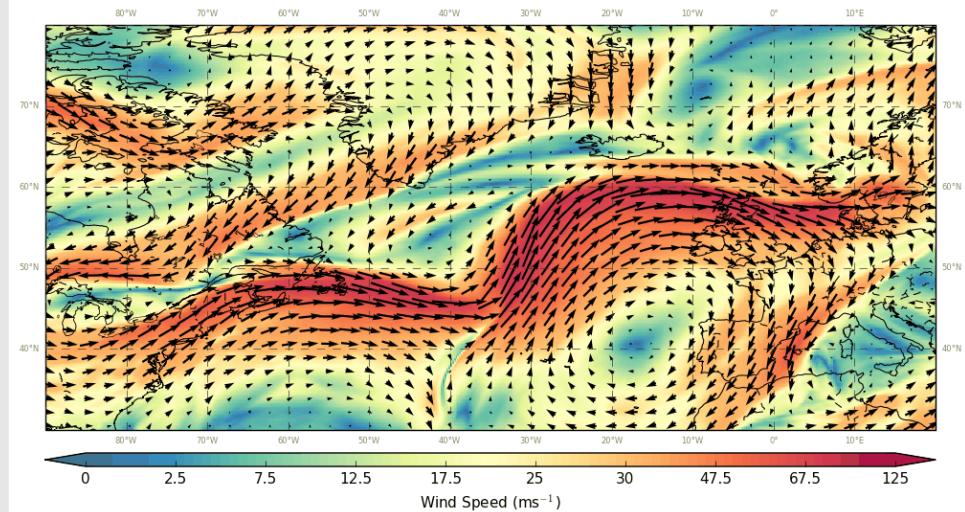
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Precipitation and Clouds

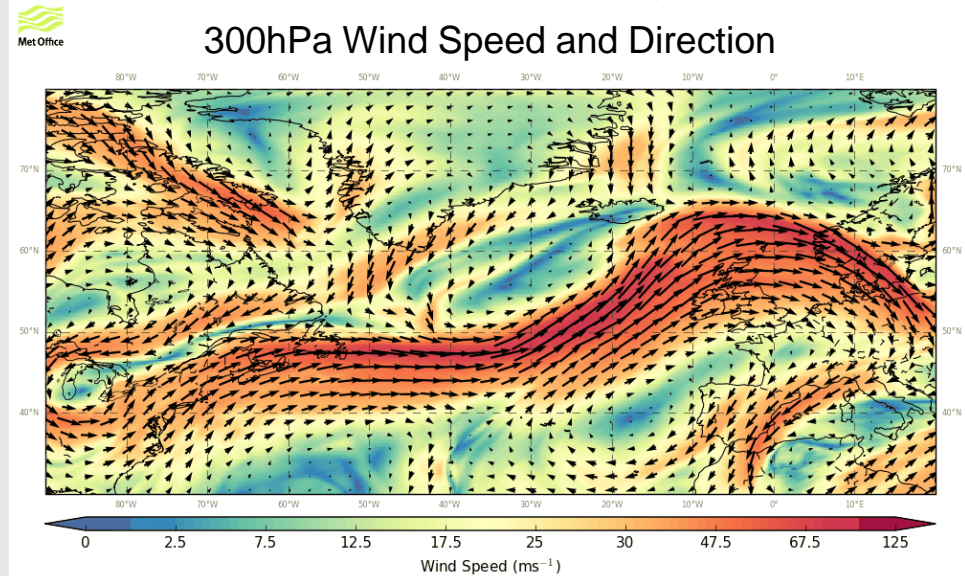
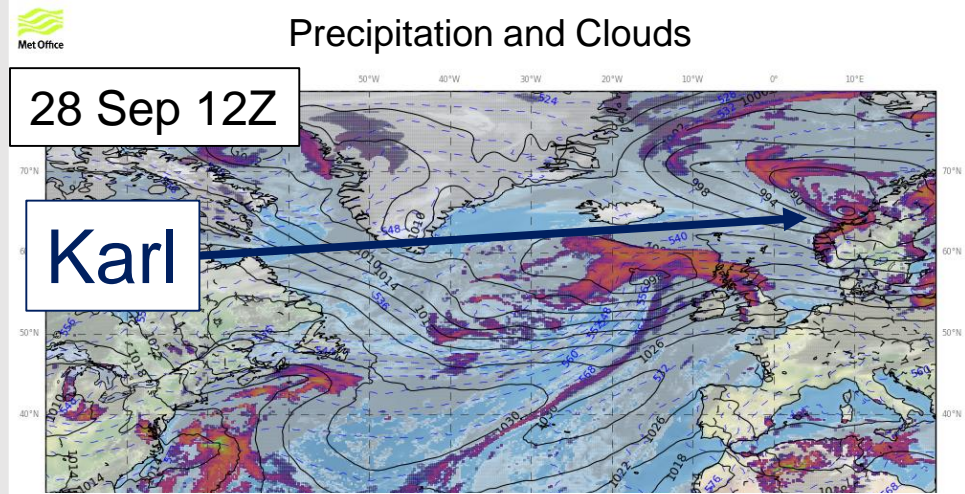


300hPa Wind Speed and Direction



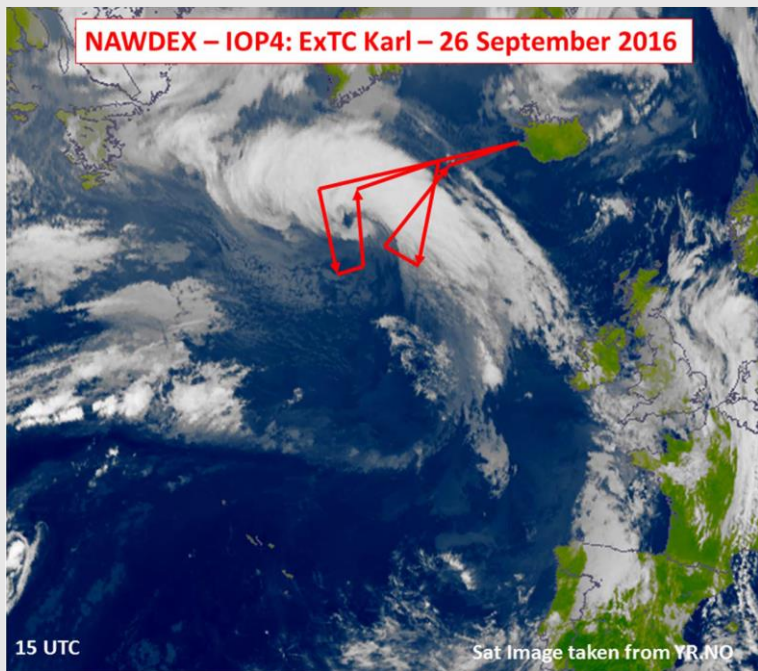
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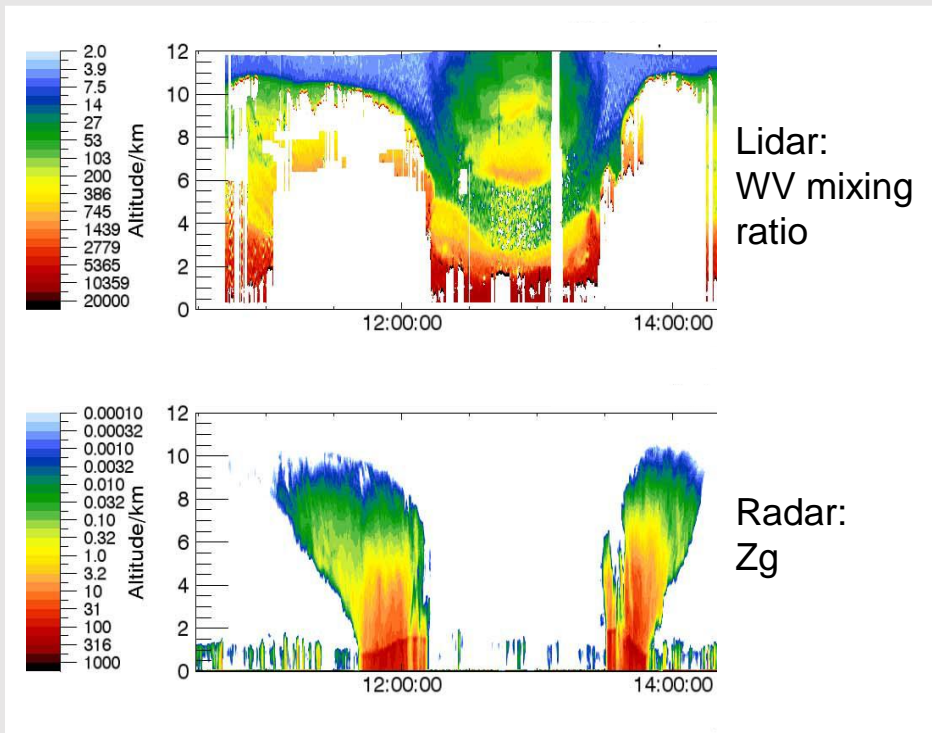


26 Sept: Interaction with the jet stream

HALO flight track (flight: 10am to 7pm)

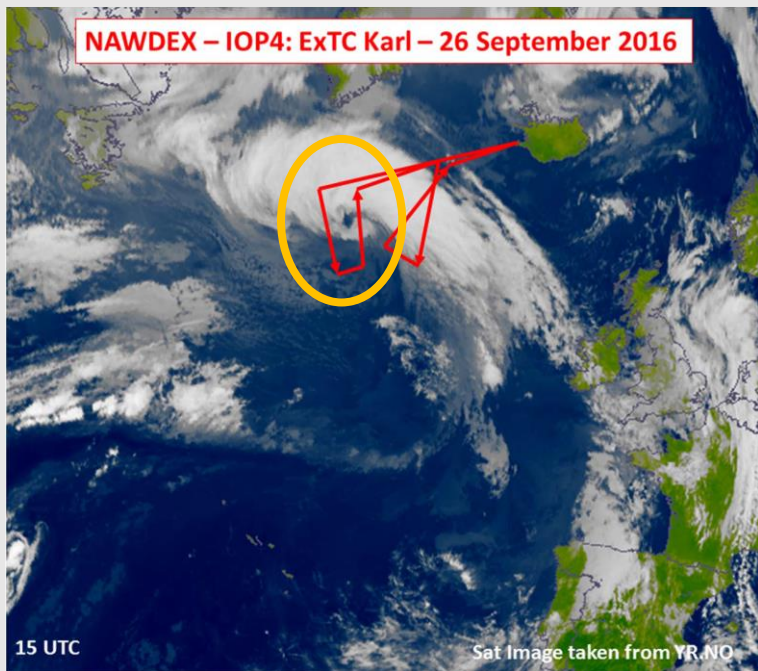


Plots Courtesy: Andreas Schäfler

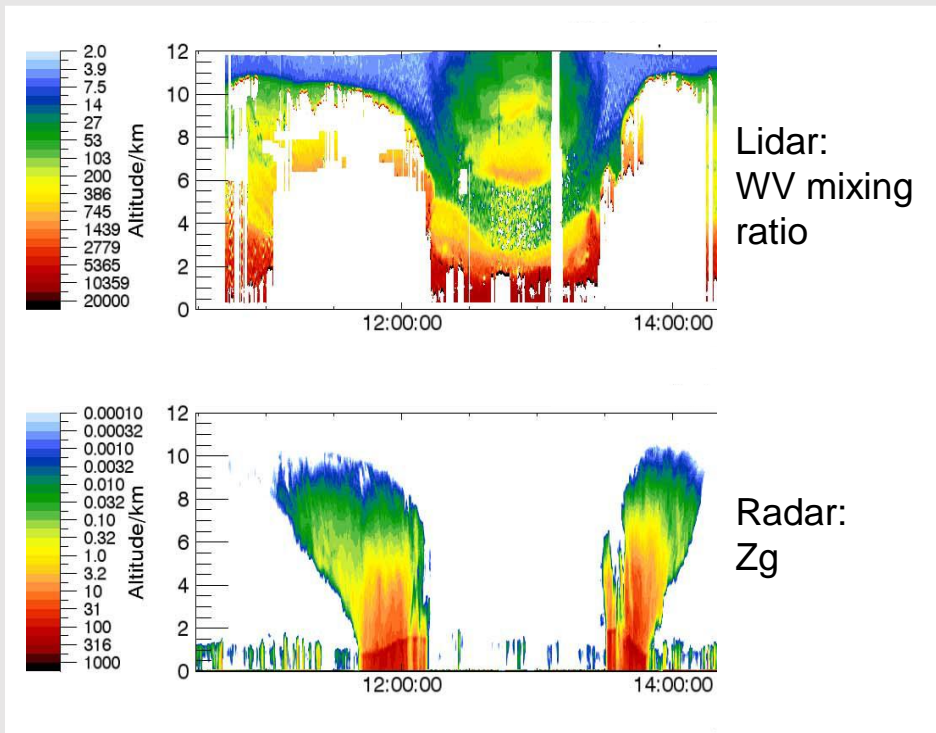


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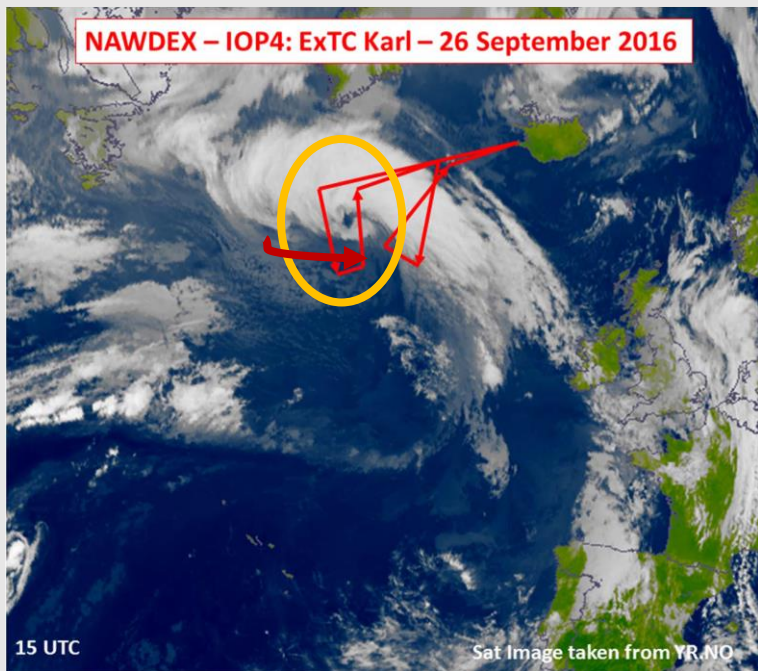


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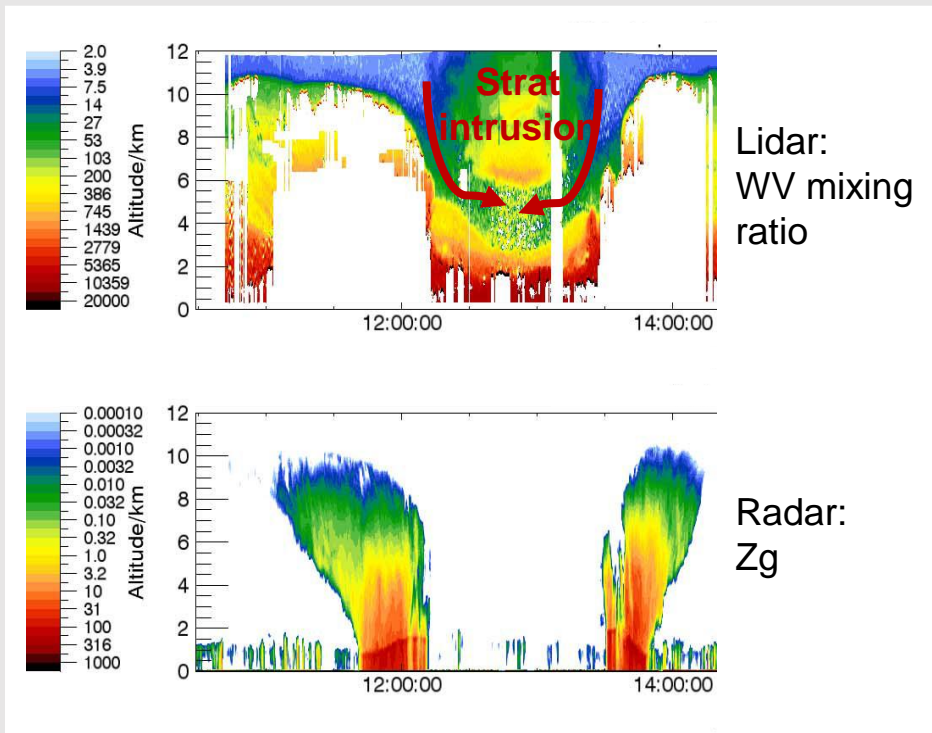


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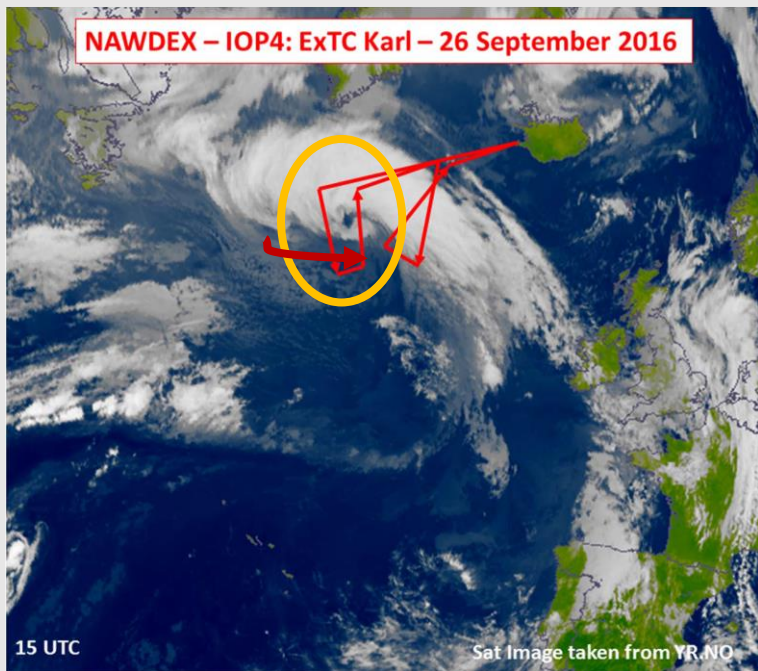


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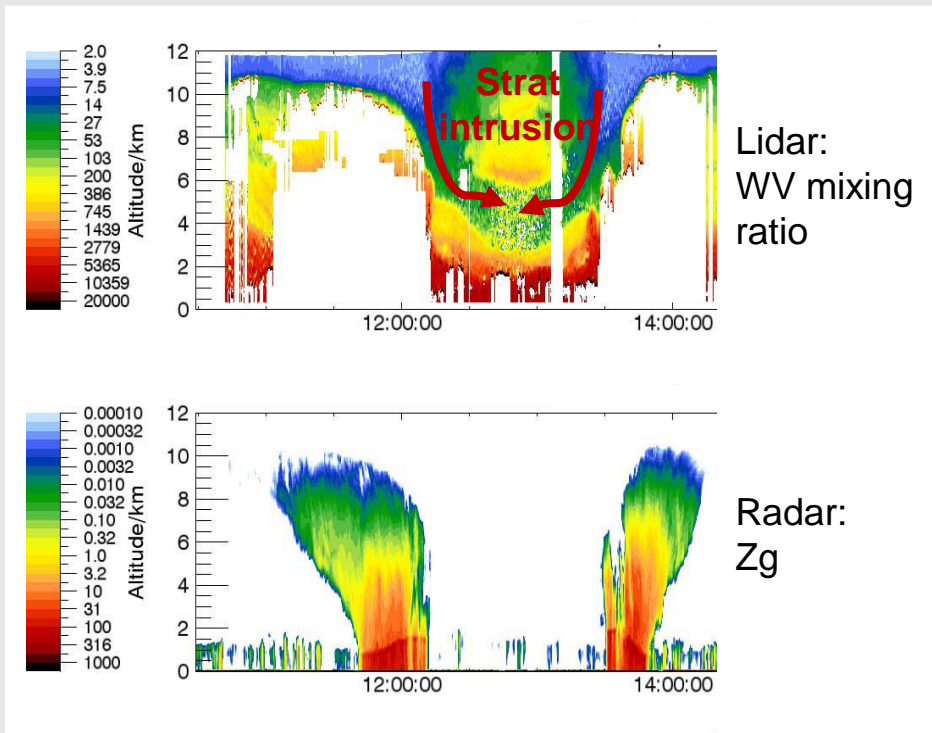


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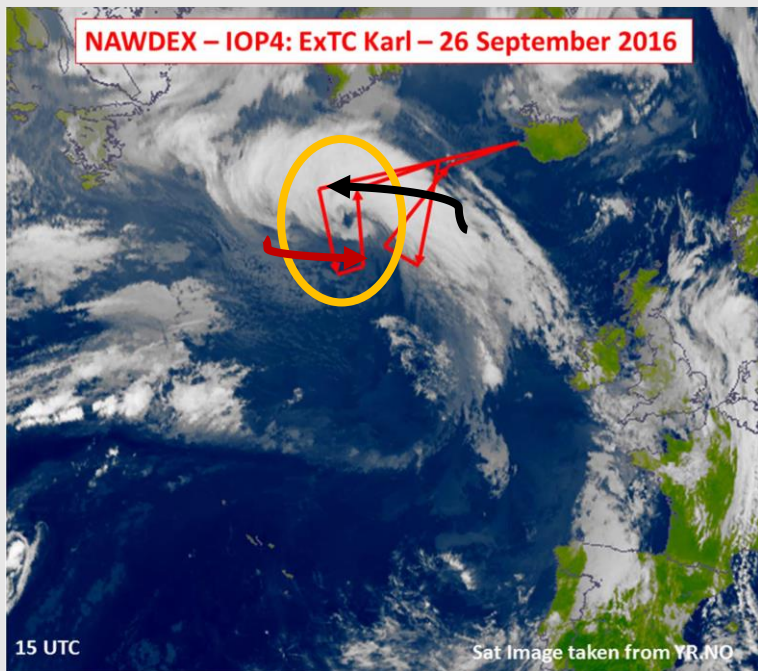


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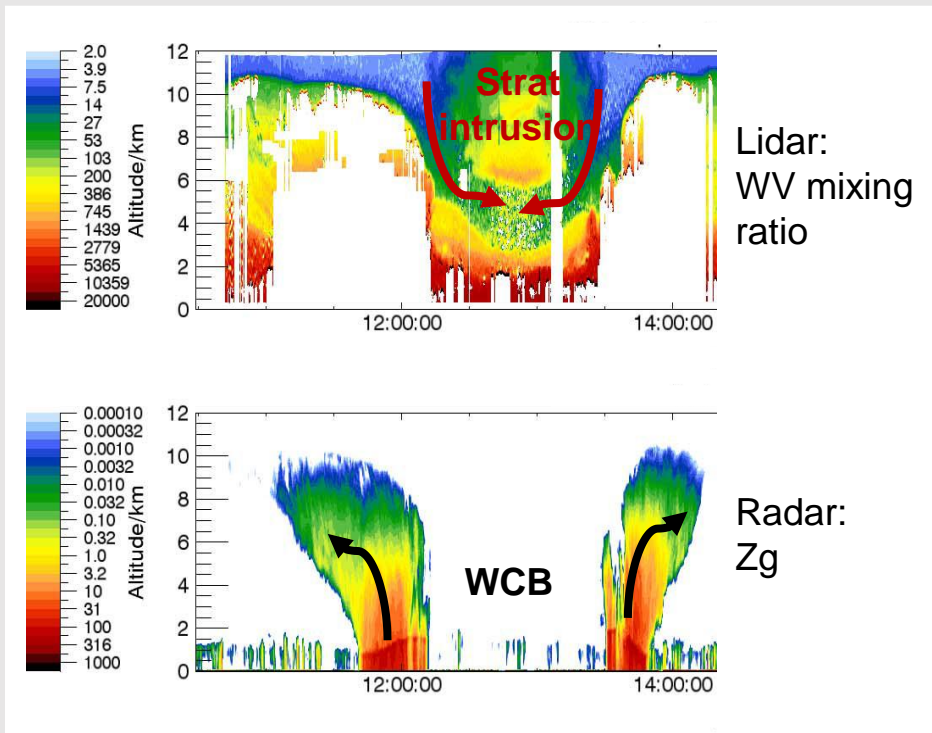


26 Sept: Interaction with the jet stream

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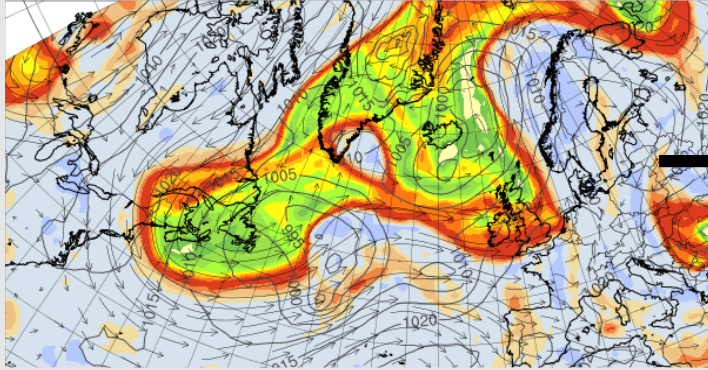
Plots Courtesy: Andreas Schäfler



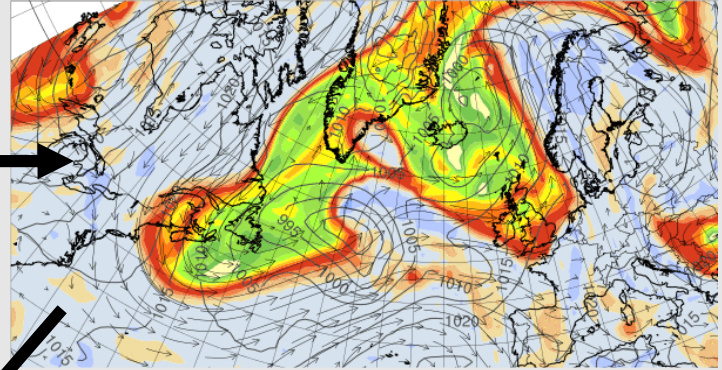
26 Sept: Interaction with the jet stream

$$PV = \frac{\zeta \cdot \nabla \theta}{\rho}$$

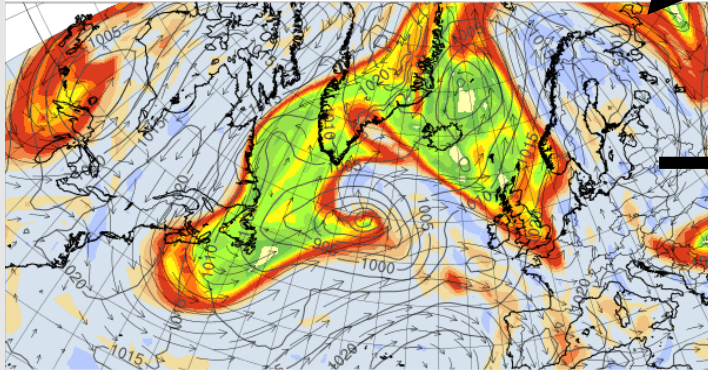
PV@320K at 20160926_00



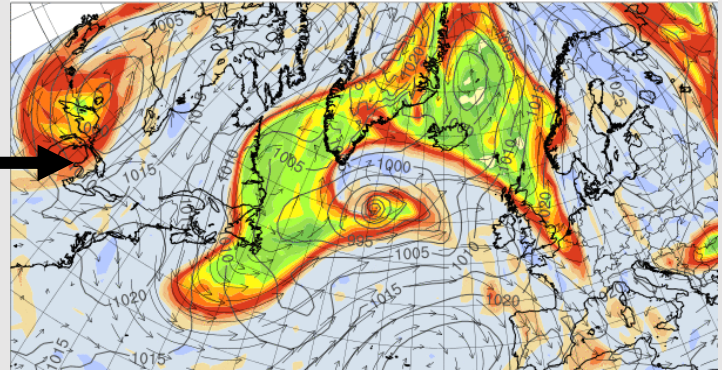
PV@320K at 20160926_06



PV@320K at 20160926_12

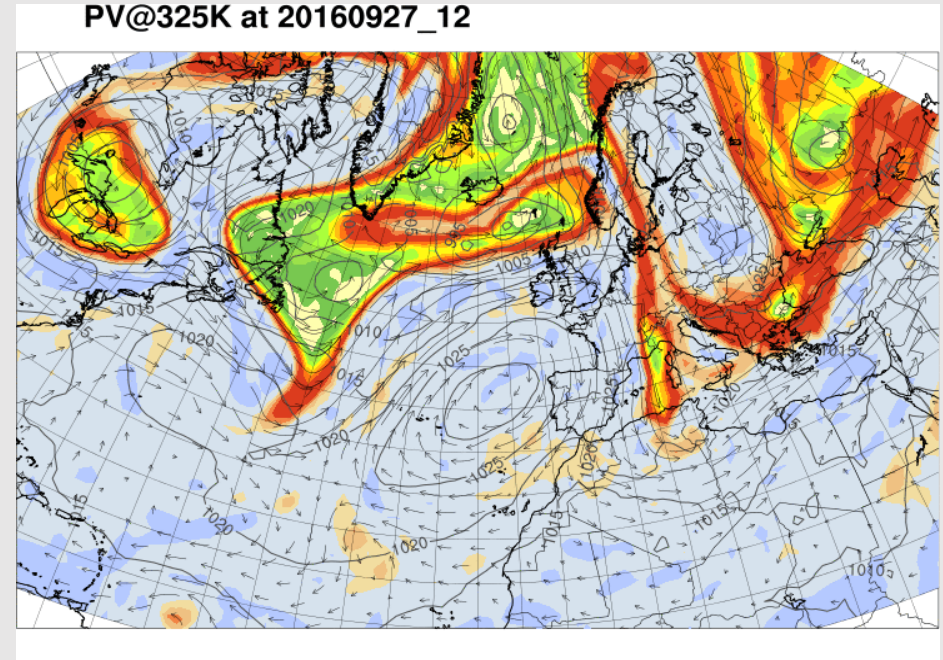
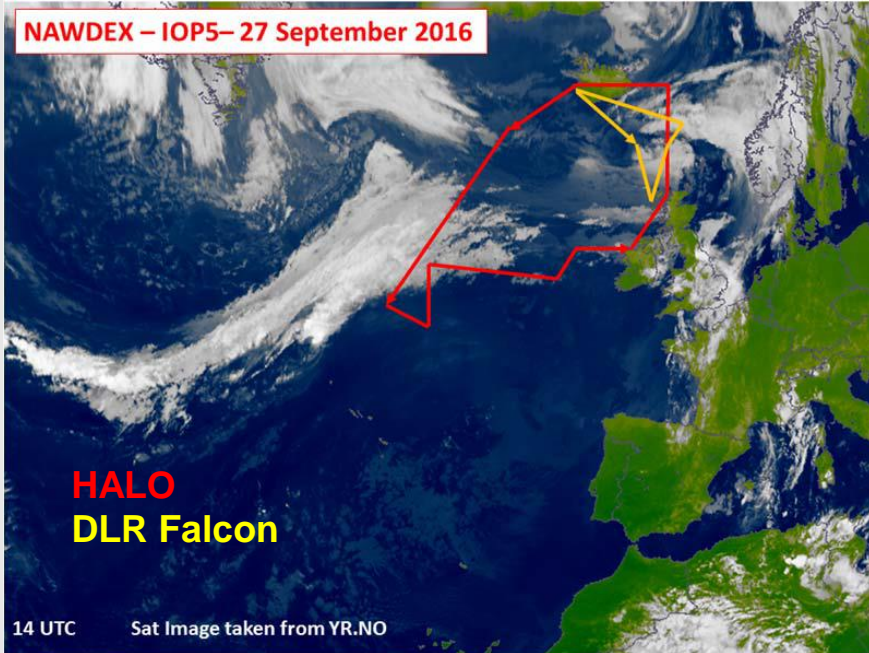


PV@320K at 20160926_18

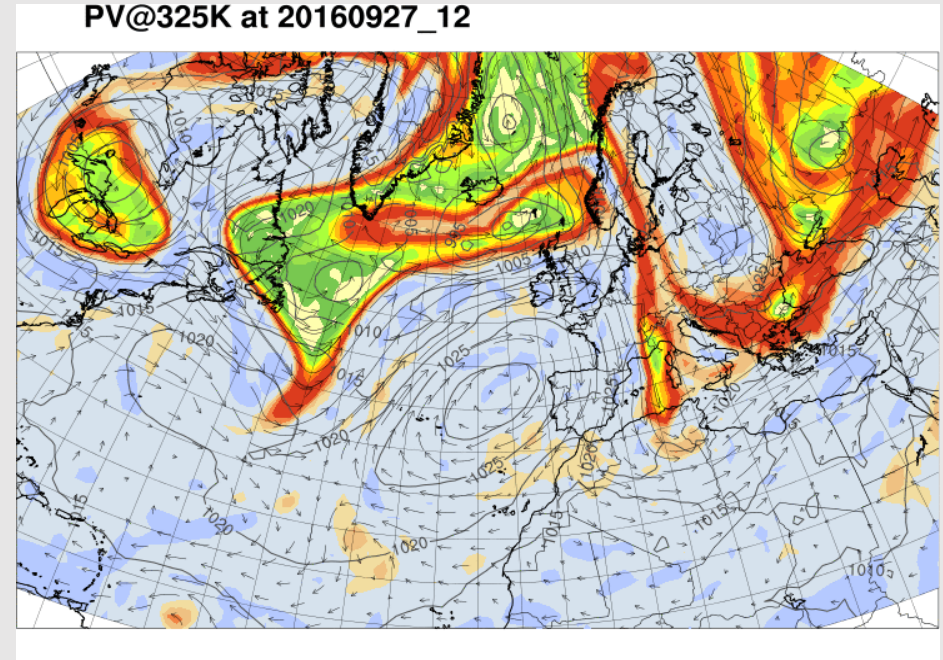
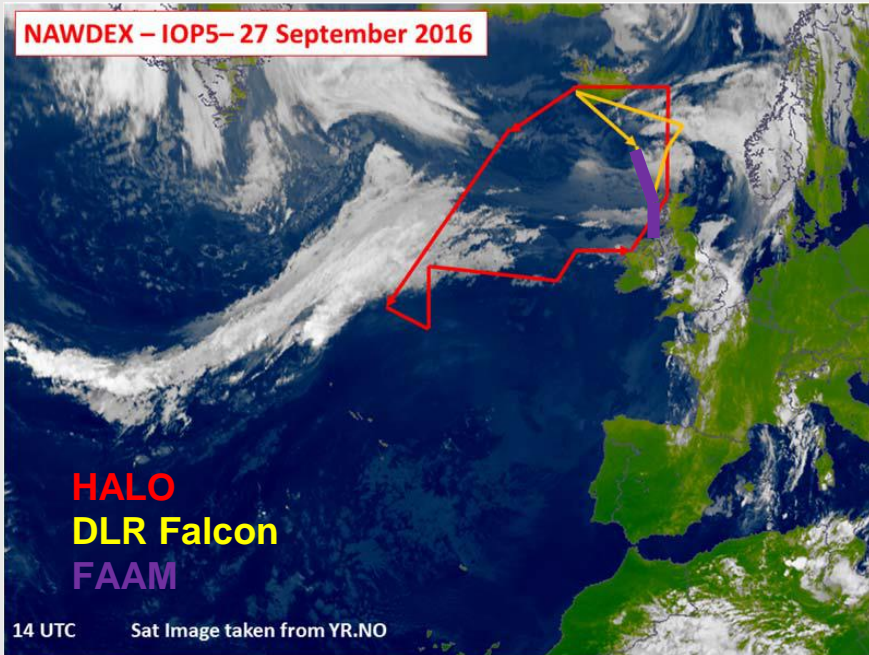


Plots
Courtesy:
Andreas
Schäfler

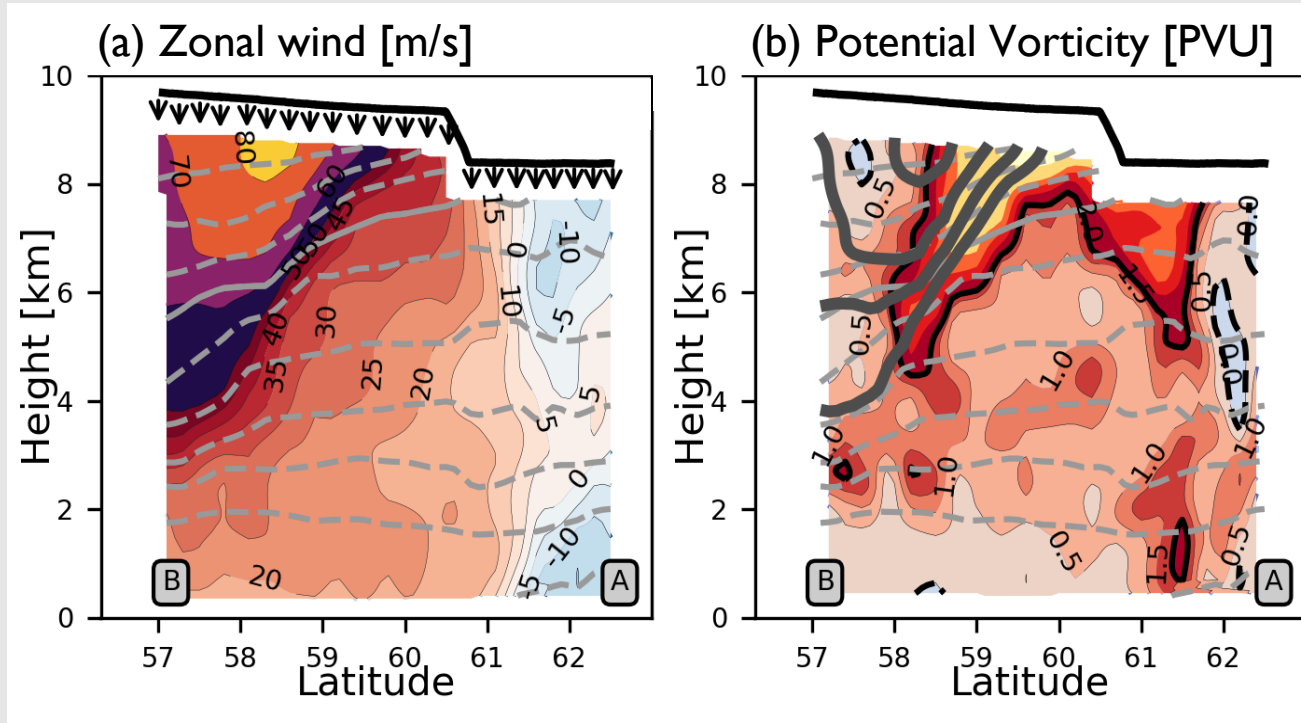
27 Sept: Strong jet streak North of UK



27 Sept: Strong jet streak North of UK



27 Sept: Strong jet streak North of UK



Recap: 1-hourly animation

<http://www.met.reading.ac.uk/~ben/karl.gif>

Predictability

To assess predictability at a glance:
Rate of spread of EC ensemble with respect to lead time

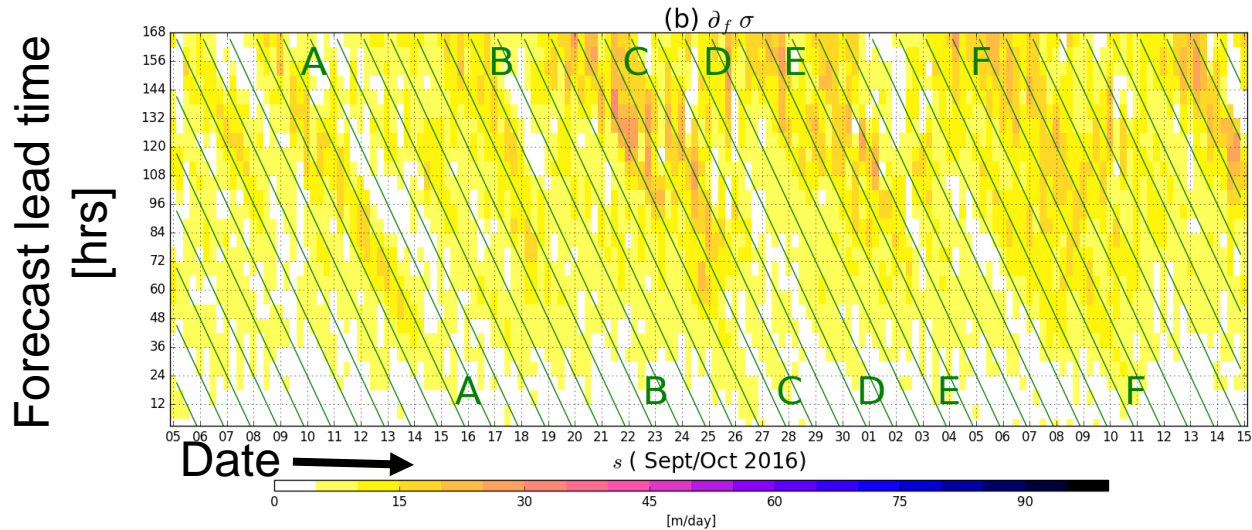


Figure Courtesy: Claudio Sanchez

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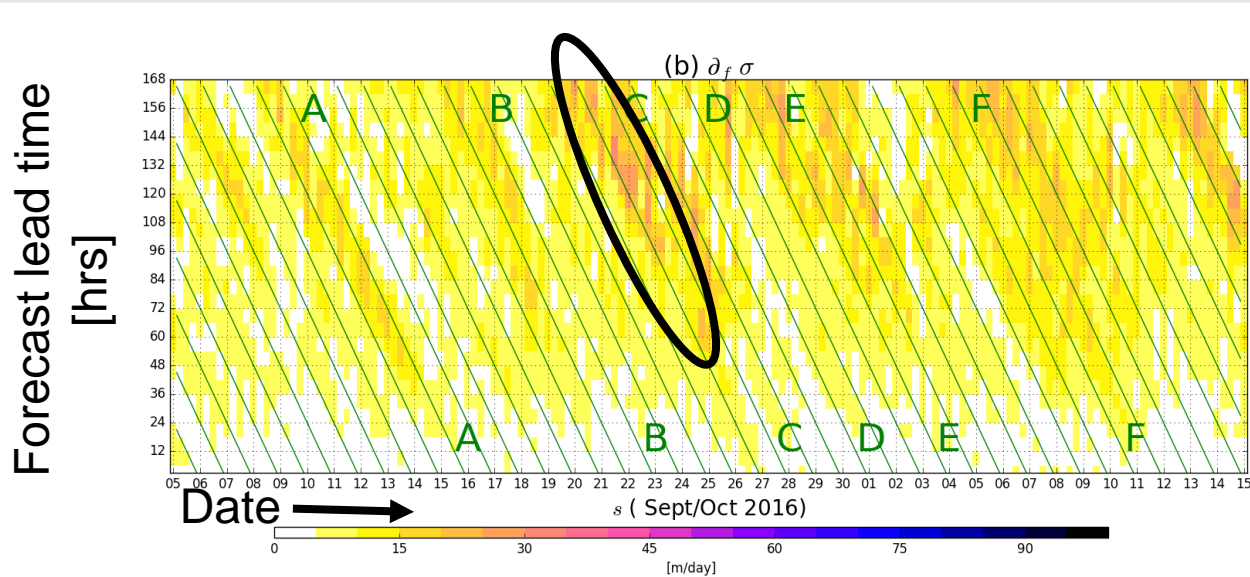
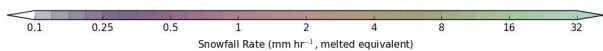
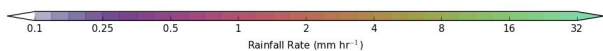
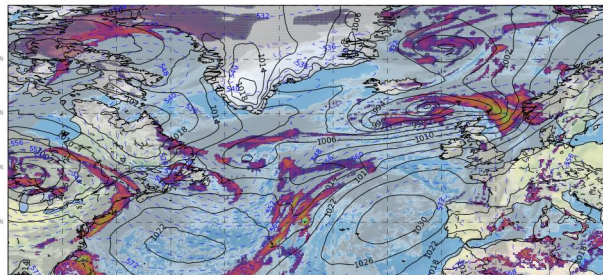
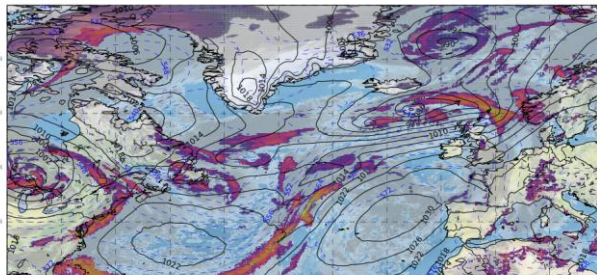


Figure Courtesy: Claudio Sanchez

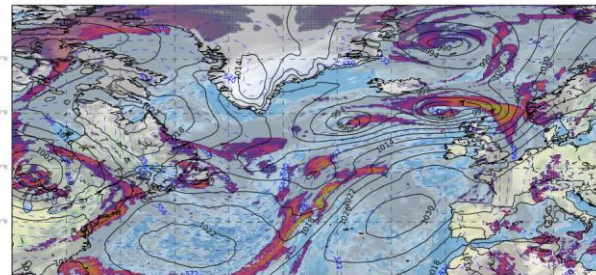
Analysis (T+0)



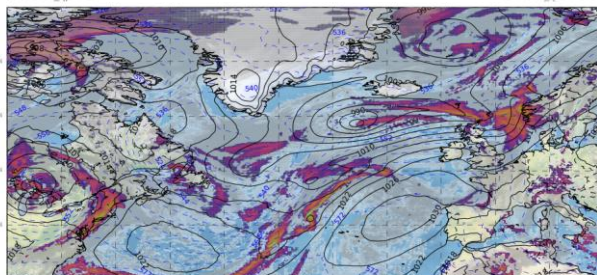
T+24 Forecast



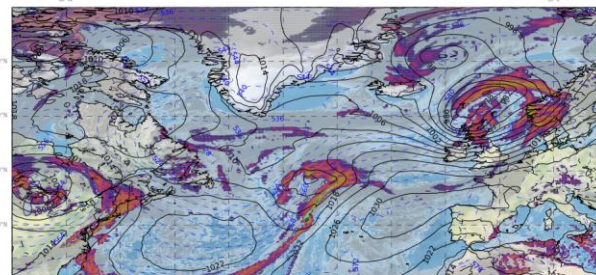
T+48 Forecast



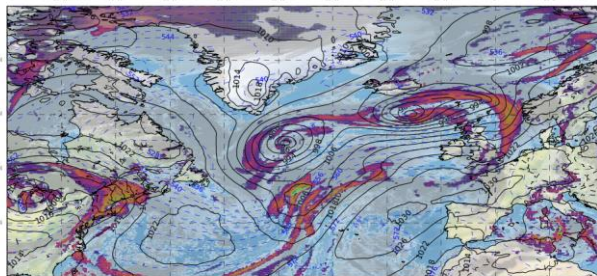
T+72 Forecast



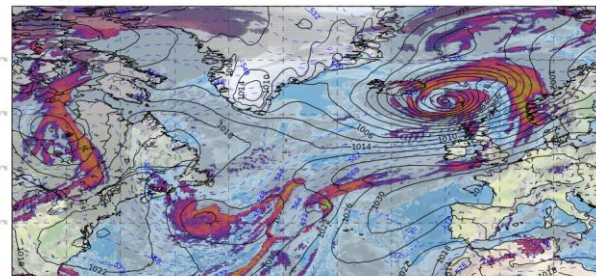
T+96 Forecast



T+120 Forecast



T+144 Forecast



UKMO Forecasts

All valid at 12Z 27 Sept

Solution fairly well converged at 3 day lead time

Very jumpy beyond 3 days

Summary

- Karl was a long-lived tropical system which reached tropical storm intensity on **15 Sept**
- Progressed polewards rapidly on **25 Sept**
- Interacted with the jet stream and re-intensified on **26 Sept**
- Strong jet streak (~ 90 m/s) passed to the North of the UK on **27 Sept**
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- Link to click through some plots from the whole period:
<http://www.met.reading.ac.uk/~ben/nawdex/analyses>
- Animation: <http://www.met.reading.ac.uk/~ben/karl.gif>